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Mount Wellington Cable Car Project

S U M M A R Y

1. Night time ambient noise level at the base station is Leq (15.min) = 24.6 dB(A) and 40.2 dB(C). The background L90 = 22.6 dB(A). During the day, Leq = 44.2 dB(A) and L90 = 39 dB(A).

2. When the difference between the dB(C) - dB(A) noise levels is greater than 15 dB the low frequency noise component is regarded as annoying and the noise attracts a penalty of 5 dB. Hence the adjusted ambient (Leq) noise level is 24.6 + 5 = 29.6 dB(A) and the adjusted background L90 noise level is 22.6 + 5 = 27.6 dB(A).

3. Based on the measurements {19/2/2007 Gimmelwald Cable Car report, Page 5,where the noise level at the rear of the terminal building is 51.7 dB(A) at 13.8 m} the noise level at the nearest residence 236 m away is calculated to be Leq = 27 dB(A). This noise level marginally meets the night time permitted L90 + 5 dB noise level of 27.6 dB(A).

4. AS/NZS 2107:2016 recommends a noise level INSIDE bedrooms in rural areas ranging from 25 dB(A) to 30 dB(A).

5. Based on the Gimmenwald cable car survey, the calculated noise levels at 50 m from the towers (microphone at 1.5 m), are as follows:
   Tower 1 (45 m high) Leq = 48.7 dB(A)
   Tower 2 (55 m high) Leq = 47.8 dB(A) and
   Tower 3 (35 m high) Leq = 49.5 dB(A)

6. The above noise levels meet the requirements of A.11.1, that is, “the noise from point sources must not exceed 50 dB(A) at any point within 50 m of the source”.

7. Indications are that attention to attenuation measures during the detailed design stage will enable the night time L90 + 5 dB criteria to be met at the nearest residence near the base station.

8. Community complaints regarding the cable car noise are unlikely and the noise limits set by the H.C.C. are met.

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INTRODUCTION:

Noise annoyance depends on the following factors:

1. The existing noise level
2. The new noise level
3. Whether the new noise has tonal components
4. Whether the new noise has impulsive components
5. The time of the day the new noise occurs
6. Whether the new noise carries unwanted intelligence such as reversing alarm signals, p.a. announcements, amplified telephone ringing
7. Noise annoyance also depends on the listeners' perception of whether the noise is regretfully caused, imposed in ignorance or inflicted as an act of aggression.

Qi Li et al stated that "low frequency noise has been found to adversely affect human concentration and sleep". JASA, vol 135, part 5, May 2014, page 2718. The Tasmanian Noise Measurement Procedures Manual states that where the dB(C) - dB(A) difference is greater than 15 dB then an adjustment of 5 dB is made.

Noise measurements were conducted on numerous occasions during the day and at night time at locations shown on pages A 2, A 3 A4 and B 2 and B 3. Measurements were also conducted at night near the base station and at the pinnacle partly to see if there was any variation in the measured noise levels. Weather conditions were good for such measurements, that is, no rain and little or no wind. The attached appendices A, and B give the results of our noise measurements and analysis.

RESULTS:

NOISE CLIMATE:

In the table on page B 9, column 9 (Loc 1, near the base station, 20:37 h) Ln is the noise level exceeded for n % of the sampling time. For example, for a measurement duration of 15 minutes, L90 = 22.6 dB(A). This means that for 90 % of the 15 minute sampling time, that is, 13.5 minutes, the noise level was 22.6 dB(A) or more. L90 is a good descriptor of the background or base noise level.

Similarly, L10 = 26.0 dB(A). It means that for 1.5 minutes the noise level was 26 dB(A) or more. L10 is a good descriptor of the average of the higher noise levels encountered and is often used in traffic noise studies.

The last row shows Leq(A). This is the equivalent 'A' weighted noise level. A fluctuating noise level having an Leq = 24.6 dB(A) has the same acoustic energy as a steady noise of 24.6 dB(A).

Page B 11 shows statistical noise analysis of night time noise on 6/5/2019. The L10, L90 and Leq noise levels are almost identical indicating little variation in the noise levels.

NOISE POLICY, STANDARDS and PROVISIONS:

Par. A6.1 Noise states "Noise from point sources of sound must not exceed 50 dB(A) at any point within 50 m of the source'.

The Hobart City Council Interim Planning Scheme requires that noise emissions measured at the boundary of a residential zone must not exceed the following:

a) 55 dB(A) (LAeq) between the hours of 0700 and 7.00 pm;
b) 5 dB(A) above the background (LA90) level or 40 dB(A) (LAeq), whichever is the lower, between the hours of 7.00 pm and 7.00 am;
c) 65 dB(A) (LAmax) at any time.

In addition, the Tasmania Environment Protection Policy (Noise) 2009 document has in Table 1 – Acoustic environment indicator levels. These are indicative and not mandatory noise levels. For outside bedrooms (sleep disturbance, window open) the noise level is Leq = 45 dB(A) with a maximum noise level Lmax = 60 dB(A) over an eight hour time base. For inside bedrooms, the noise level is Leq = 30 dB(A) with Lmax = 45 dB(A).

For bedrooms in houses near minor roads, Australian /New Zealand Standard AS/NZS 2107:2016 has a recommended design sound level for steady or quasi steady noises of Leq = 30 dB(A) which is regarded as satisfactory and Leq =- 35 dB(A) which is regarded as the maximum design sound level.

Carter N.L, et al 'Overnight Traffic Noise Measurements In Bedrooms and Outdoors, Pennant Hills Road, Sydney – Comparisons With Criteria For Sleep', Acoustics Australia, Vol 20,No 2, page 52, presented a table (Table 2) where the mean outdoor/indoor attenuation was 17.0 dB(A) for bedrooms with windows slightly open and 21.5 dB(A) with windows closed.

The requirement of L90 + 5 dB = 27.5 dB(A) is stringent and is less than the AS/NZS 2107:2016 recommended design noise level for INSIDE bedrooms of 25 dB(A) to30 dB(A) for houses in rural areas

SPECTRAL ANALYSIS:

Pages A 17, A18, A 19 and B 13 and B 14 19 show the spectral content of the noise at the various locations. Whereas the 1/3 octave band spectra do show some spectral features (for example 50.7

db at 63 Hz at Loc 5 on page B 18), there appear to be no strong tonal components that attract tonal penalties.

Noises having tonal and impulsive features attract a penalty of about 5 db(A) because a noise with a tonal component is judged to be more annoying than a similar level sound without a tone.

CALCULATIONS OF CABLE CAR NOISE LEVELS:

For example, consider Tower 3.

This tower is 35 m high. Assume the measuring microphone is at a height of 1.5 m. Hence the difference is 35 – 1.5 = 33.5 m. This is the vertical distance of as triangle whose base is 50 m. The hypothenuse of this right angled triangle is (33.5^2 + 50^2)^0.5 = 60.185 m

Page 2 of the Gimmenwald Cable Car report gives the noise level of the cable car movement across the tower as Leq = 56.5 dB(A) with the microphone at 26.95 m from the cable bar.

The cable car movement across the tower was the highest noise level recorded. The cable movement across the tower registered 53.7 dB(A), that is, a lower reading.

Hence the noise level at 50 m = 56.5 – 20 log (60.185/26.95) = 49.5 dB(A)

Similar calculations for towers 2 and 1 give noise levels of 47.8 dB(A) and 48.7 dB(A) respectively and hence all three towers generate noise levels less than 50 dB(A) at 50 m.

Noise levels at nearest residence to the base station

The night time L90 = 22.6 dB(A). See page B 9, Loc 1 starting at 20:37 h)
Page B 13shows that at loc 1, the Leq noise levels were 245.6 dB(A) and 40.2 dB(C). The difference between dB(C) and dB(A) = 40.2 – 24.6 = 15.6 dB. Hence we can add a penalty of +5 dB(A) to the noise level. See par 6.5, page 24 of the Noise Measurement Procedures Manual, July 2004. Hence we add + 5 dB to L90 that is, 22.6 + 5 = 27.6 dB(A).

The nearest residence is some 236 m from the base station.
Hence if the noise is regarded as a point source as seen from 236 m, then the noise level at the nearest residence is:

51.7 – 20 log (236/13.8) = 51.7 – 24.7 = 27dB(A).

In addition there is some excess attenuation due to propagation over grass and through trees which might amount to 1 dB to 2 dB. Atmospheric effects (gentle breeze from base station to residence) might increase the noise level by a couple of dB.

The adjusted L90 + 5 = 27.6 dB(A).

The noise level from the base station could be 27 + 2.5 dB (façade effect) = 29.5 dB(A). As mentioned, AS/NZS 2107:2016 recommends a noise level INSIDE bedrooms in rural areas of 25 dB(A) to 30 dB(A). The 27 dB(A) noise from the base station is a noise level that appears OUTSIDE a bedroom. The L90 + 5 dB condition is met outside bedrooms.

RECOMMENDATIONS:

1. It is recommended that noisy and vibrating machinery be vibration isolated from the buildings, where possible, with inertia bases on vibration isolators. Pipes and cables to the units should have 360 degree loops in them to reduce vibration from being transmitted to the building envelope and be supported with clamps lined with neoprene.

2. It is also recommended that future equipment be selected with noise ratings in mind. For example, ‘ totally enclosed , fan cooled (TEFC) motors produce about 5 dB greater sound pressure level than equivalent sized drip proof (DRPR) electric motors.

CONCLUSION:

The noise requirements set by the Wellington Park Management Trust and the H.C.C. Interim Planning Scheme are met based on the measurements and technical data in the Grimmenwald Cable Car Noise Report of 19/2/2007.

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